Insituform iPlus Composite

An Innovative Approach for Medium & Large Diameter Culvert Repairs
Insituform Cured-in-Place Pipe
At Insituform, we understand the demand on our customers to get more done with less. In keeping with that principle, Insituform has improved standard CIPP to do more with less.
The same carbon fiber that makes the aircraft of today lighter, stronger and more fuel-efficient also expands the CIPP technical envelope to allow Insituform® to do more with less.
What is it?

A high-strength, fiber-reinforced composite Cured-in-Place-Pipe for rehabilitation of medium and large diameter pipes.

- Fiber reinforcement is oriented to provide maximum stiffness which results in thinner tube walls.
  - Carbon Fiber
  - Glass Fiber
CIPP Installation Process

• Engineer proper solution.

• Manufacture a custom tube.
Manufacturing Facility
Tube Wet Out Process

In-Line Mixer

Serial Vacuum

Gap Rollers

Conveyor
CIPP Installation Process

- Install tube in host pipe.
- Cure resin with steam.
I-96 MDOT Existing CMP
5’7” x 7’11”
CIPP within MDOT pipe.
CIPP Installation Process

Finished Product
Composite Pipe

More Strength - Less Wall

iplus Composite™ Sandwich Construction

High-stiffness, fiber-reinforced layers

Conventional CIPP material
More Strength - Less Wall

• Force exerted on liners is in the hoop direction

• Optimum orientation of reinforcing fibers is also in hoop direction
### More Strength - Less Wall

#### Design Example

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host pipe equivalent diameter (inches)</td>
<td>48</td>
</tr>
<tr>
<td>Host pipe ovality (%)</td>
<td>5</td>
</tr>
<tr>
<td>External head of water above invert (ft)</td>
<td>20</td>
</tr>
<tr>
<td>Soil depth above invert (ft)</td>
<td>30</td>
</tr>
<tr>
<td>Soil modulus (psi)</td>
<td>1000</td>
</tr>
<tr>
<td>Soil density (lb/ft^3)</td>
<td>120</td>
</tr>
<tr>
<td>ASSHTO live load (lbs)</td>
<td>16000</td>
</tr>
<tr>
<td>Safety factor</td>
<td>2</td>
</tr>
<tr>
<td>Design method</td>
<td>AWWA ASTM F1216</td>
</tr>
</tbody>
</table>

#### Mechanical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Standard Insituform®</th>
<th>Insituform iplus™ Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexural modulus (psi)</td>
<td>400,000</td>
<td>1,374,900</td>
</tr>
<tr>
<td>Flexural strength (psi)</td>
<td>4,500</td>
<td>20,330</td>
</tr>
<tr>
<td>Wall thickness (mm)</td>
<td>34.5</td>
<td>20</td>
</tr>
</tbody>
</table>
Doing More $ $ $ $ $ $ $ With Less

- More Strength
- More Flow
- More Storage Capacity
- More Accomplished

- Less Wall
- Less Cross-sectional Area Loss
- Less Overflows
CIPP DOT Installation

Improved Flow
Hydraulic analysis performed on DOT culvert in western Michigan.

35% flow increase
Better for the Environment

- Less energy to manufacture
- Less energy to transport and handle
- Less energy to install
- Less time on site
Production Energy

Steel

PVC

Cement
Installation Energy
“Manufacture, hauling & installation”

Energy

Graph showing the percentage of manufacture, transport, and installation costs for various materials:
- Concrete
- Cast Iron
- PVC
- Standard CIPP
- iplus CIPP
iplus Composite™ - What Sets It Apart

- Patents defining materials and construction
- Third Party testing addressing corrosion and structural performance
- 10,000-hour testing for long-term evaluation
- Fast installation with minimal disruption
- Installation experience provides consistency of product and capability to overcome site issues
Industry Standards 3rd Party Testing

- ASTM F1216 Chemical Resistance
- ASTM D5813 Chemical Resistance
- ASTM D5813 Chemical Resistance in a deflected condition
- ASTM D2990 Flexural Creep
Long-Term Testing

Creep Laboratory

Third party standards compliance testing

ASTM D5813, ASTM D2990
(10,000 hour tests)

ASTM D2990
Air Inversion/Difficult Access
iplus Composite™ Installation History
Partial listing of customers

- St. Louis MSD
- Kansas City Water
- Virginia DOT
- City of Brea, CA
- Tampa, FL Storm